



HEURTEY PETROCHEM

FH01-FJ-001

**FIRED HEATER DATA
SHEET**



HEURTEY PETROCHEM

dsHTR-4

Owner **PETRONET** Reference No **AR05016**
Purchaser **Foster Wheeler SA** Document No **FH01-FJ-001**
Location **Gauteng (South Africa)** Service **Distillation column reboiler**
Unit - Item N° **FH-001**
Job No **25913-57906** Heater type **Vertical cylindrical**
No off **1**
Equipment **FIRED HEATER** Total duty **5.611 MW**

Process data

		70: 30 Feed		50: 50 Feed		30: 70 Feed	
		Radiant	Convection	Radiant	Convection	Radiant	Convection
1	* Operating case	Reboiler		Reboiler		Reboiler	
2	* Heater section	Reboiler		Reboiler		Reboiler	
3	* Service	Reboiler		Reboiler		Reboiler	
4	* Heat absorption duty	5.611		4.700		2.875	
5	* Fluid	Hydrocarbons		Hydrocarbons		Hydrocarbons	
6	* Flow rate	174576		146434		89166	
7	* Allowable pressure drop	3		3		3	
8	Calculated pressure drop	1.4					
9	* Av. heat flux density (allowable)						
10	Av. heat flux density (calculated)	37855					
11	* Max. heat flux density(allowable)						
12	Max. heat flux density(calculated)	57540					
13	* Velocity limitation						
14	Process fluid mass velocity (clean)	1301					
15	* Max. inside film temperature (allowable)						
16	Max. inside film temperature (calculated)	386					
17	* Fouling allowance	0.000176					
18	* Coking allowance						

Inlet conditions

19	* Liquid flow rate	kg/h	174576		146 434		89166
20	* Vapour flow rate	kg/h	-		-		-
21	* Temperature	°C	293		293		293
22	* Pressure	Barg	2.6				
23	* Liquid density	kg/m3	632		634		632
24	* Vapour molecular weight		-		-		-
25	* Viscosity (liquid / vapour)	cP	0.28		0.280		0.28
26	* Specific heat (liquid / vapour)	kJ/kg°C					
27	* Conductivity (liquid / vapour)	W/m.°C	0.0895		0.0895		0.0896

Outlet conditions

28	* Liquid flow rate	kg/h	123957		103921		63251
29	* Vapour flow rate	kg/h	50644		42513		25922
30	* Temperature	°C	312		312		312
31	* Pressure	Barg	1.2		1.2		1.2
32	* Liquid density	kg/m3	626		626		626
33	* Vapour molecular weight		200		200		200
34	* Viscosity (liquid / vapour)	cP	0.29 / -		0.29 / -		0.29 / -
35	* Specific heat (liquid / vapour)	kJ/kg°C					
36	* Conductivity (liquid / vapour)	W/m.°C	0.087 / 0.0308		0.087 / 0.0308		0.087 / 0.0308

Remarks

37	*Decoking requirements						
38	*Enthalpy chart reference						
39							
40							
41							

Combustion design conditions

42	Type of fuel		Diesel				
43	Section		Radiant	Convection			
44	Operating case		70: 30 Feed				
45	Excess air	%	25				
46	Calculated heat release	MW	6.927				
47	Calculated fuel efficiency (LHV)	%		81			
48	Guaranteed fuel efficiency (LHV)	%		80			
49	Heat loss	%	2				
50	Flue gas temp. leaving the section	°C	802	363			

Issue table

5							
4	02/05/2006	PB	HL	HL	Updated - modification of pilots and igniters		
3	15/11/2005	PB	HL	DGo	Updated		
2	06/09/2005	PB	HL	DGo	Updated with the client comments		
1	30/06/2005	PB	HL	DGo	Updated with the client comments		
0	30/05/2005	PB	HL	DGo	First Issue		
Rev	Date	By	Checked	Approved	Designation		

FIRED HEATER DATA SHEET acc. to API Std 560 3rd ED. May 2001,

SI units

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Mechanical design conditions

1	Section		Radiant	Convection				
2	Service		Reboiler					
Coil Design								
3	Design basis for tube thickness (code or spec.)		API 530 5th ED. Jan 2003					
4	Stress-to-rupture min. or average / life basis, h		100 000					
5	*Design pressure elastic/creeping range	Barg	8.5					
6	*Design fluid temperature (max. operating)	°C	327					
7	Temperature allowance on fluid	°C	15					
8	*Corrosion allowance	mm	3					
9	Hydrostatic test pressure	Barg	17.4					
10	Post welding, welds heat treatment		N/A					
11	Percent of welds fully radiographed	%	10%					
12	Maximum (clean) tube metal temperature	°C	417					
13	Design tube metal temperature,	°C	433					
14	Inside film coefficient (API basis)	W/m². °C						
Coil arrangement								
15	Tube orientation (vertical, horizontal or helical)		vertical	horizontal				
16	Co- or countercurrent or cross flow			counter-cur.				
17	*Material grade		Grade B	Grade B				
18	Material specification		A106	A106				
19	Outside diameter	mm	168.3	168.3				
20	Wall thickness (minimum) (average)	mm	7.11	7.11				
21	N° of flow passes		2	2				
22	N° of tubes per row			4				
23	Overall straight tube length	mm	6978	4333				
24	Effective tube length	mm	7697	3859				
25	Bare tube number		24	12				
26	Bare tubes, total exposed surface	m²	97.7	24.5				
27	Extended surface tube number		-	28				
28	Extended total exposed surface	m²	-	220.0 (note 1)				
29	Tube lay-out In-line or staggered			staggered				
30	Tube CL-CL adjacent in a row	mm		304.8				
31	Linked Tubes CL-CL	mm	457.2	304.8				
32	Spacing, tube CL to furnace refractory wall	mm	228.6	152.4				
33	N° of intermediate welds per tube							
Description of Extended Surfaces								
34	Type (studs, segmented fins or solid fins)		None	Studs				
35	Material			CS				
36	Height	mm		25				
37	Diameter (stud) or thickness (fins)	mm		12.7				
38	N° of stud/planes (at 63 pl./m) or fins/m or fins/ft			24				
39	Maximum tip temperature	°C		392				
40	Extension ratio (total area / bare area)			3.85				
Return bends or plug-headers								
41	Type : bend or plug-header (welded or rolled)		Bend	Bend				
42	Location (header box or firebox)		Firebox	Header box				
43	Quantity (one end or two ends or nb)		two ends	two ends				
44	Material (grade)		W/PB	W/PB				
45	Material (ASTM or other specification)		A234	A234				
46	Nominal rating for plug-headers (lb) or schedule		40	40				
Terminals (Connection to external piping)								
47	Type (welded or flanged)		Flanged	Flanged				
48	Flange type and face (RF or RTJ)		WNRF	WNRF				
49	Flange face finish (RM or RMS or other)							
50	Inlet : Material (ASTM spec. or grade)			A105				
51	- Size (nominal)	mm		150				
52	- Rating (lb)			300				
53	- Number of terminals			2				
54	Outlet : Material (ASTM spec. or grade)		A105					
55	- Size (nominal)	mm	150					
54	- Rating (lb)		300					
55	- Number of terminals		2					

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Mechanical design conditions , Refractory setting

	Insulation setting	Hot face temp. °C	Insulating material description	Service temp. °C	thickness mm	Specific gravity kg/m3	Anchor material	Anchor type	Casing temp. °C	Casing thick. mm
1	Radiant protected wall	638	LHV 124	1038	200	950	SS	V	< 82	5
2									(note 1)	
3										
4	Radiant unprotected wall									
5										
6										
7	Radiant arch	802	LHV 124	1038	200	950	SS	V	< 82	6
8									(note 1)	
9										
10	Radiant floor	766	HDFB	1650	65	2190	SS	V	< 91	6
11			LHV 124	1038	200	950			(note 1)	
12										
13	Conv.side		LHV 124	1038	150	950	SS / CS	V	< 82	5
14									(note 1)	
15	Soot blower lane special		Firecrete 3x	1650	75	2150	SS / CS	V		5
16			LHV 124 (note 3)	1038	75	950				
17										
18	Header box		LHV 124	1038	50	950	CS	V		6
19										
20	Breechings		LHV 124	1038	75	950	CS	V		5
21										
22	Stack insulation		LHV 124	1038	50	950	CS	V		8
23										
24	Flue 1									
25										
26	Flue 2									
27										
28	Flue 3									
29										
30	Air duct 1									
31										
32	Air duct 2									
33										
34	Air duct 3									
35										
36	Plenum chamber									
37										
38	Internal gravity wall									
39										
40										

Stack & ducts dimensions

	Location	Top elevation mm	Net free area m²	ID casing mm	Width mm	Height mm	Length mm
41	Flue gas stack	on top of convection section	+33925	1.03	1250		16825
42	Flue 1			(note 2)			
43	Flue 2						
44	Flue 3						
45	Intake air stack						
46	Air duct 1						
47	Air duct 2						
48	Air duct 3						
49	Plenum chamber						

Dampers

47	Service	Stack							
48	Number	one							
49	Blades material (grade)	SS							
50	Shaft material (grade)	SS							
51	Single or multiple blades	single							
52	Opposed or parallel blades	on hold							
53	Hand operation	yes from damper platform							
54	Counterweight	yes							
55	Actuator	yes, pneumatic							



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Notes

1 Page 1: note 1: Calculated with the following conditions:

2 Diesel temperature : 15°C

3 Relative humidity : 65%

5 Page 3: note 1: Space is provided for two future rows

7 Page 4: note 1: Average fluid temperature @ cross-over : 308°C

9 Page 5: note 1: Average casing temperature calculated with the following conditions: ambient air temperature of 27°C and no wind.

10 note 2: Calculated for a flue gas flow rate corresponding to 120% of the 70: 30 Feed case, with a velocity at stack exit of 7.5 m/s.

11 note 3: At soot blower level, first layer (cold side) = 75 mm of LHV 124 + second layer (hot side) = 75 mm of Firecrete 3x

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Combustion design conditions (continued)

1	Operating case		70:30 Feed						
2	Flue gas quantity	kg/h	11111						
3	Flue gas mass velocity through convec.	kg/m ² .s	from 1.15 to 1.72						
4	Draught at arch level	mmH ₂ O	2.5						
5	Draught at burner level	mmH ₂ O	6.9						
6	* Air temperature for efficiency calc.	°C	15						
7	Ambient air temp. for air preheat design	°C	N/A						
8	* Ambient air temp. for stack draught calc.	°C	35						
9	* Altitude above sea level	m	1538						
10	* Local atmospheric pressure	Pa	85 000						
11	Volumetric heat release	W/m ³							

Fuel-oil characteristics

12	* Identification		Diesel						
13									
14	* API°		36.2						
15	* Low heating value	kJ/kg	43105						
16	* High heating value	kJ/kg	46036						
17	* Available fuel pressure at burner	Barg	6.0						
18	* Available fuel temperature at burner	°C	25 (on hold)						
19	* Available fuel quantity	kg/s							
20	*H / C weight fraction								
21	*Viscosity at burner	cSt	5.11 (on hold)						
22	*Flash point	°C	> 60						
23	*Pour point	°C							
24	*Sulphur content	wt%	<0.4						
25	*Nitrogen content	wt%	0.035						
26	*Nickel content	wt ppm	on hold						
27	*Vanadium content	wt ppm							
28	*Sodium content	wt ppm							
29	*Ash content	wt%							
30	*Atomizing steam temp. at burner	°C	Since steam is not available, diesel will be atomised with air						
31	* Atomizing steam press. at burner	Pa							

Fuel gas characteristics

32	* Identification		Methane Rich Gas						
33									
34	* Molecular weight		16.22						
35	* Low heating value	kJ/kg	48700						
36	* High heating value	kJ/kg	54100						
37	* Available fuel pressure at burner	Barg							
38	* Available fuel temperature at burner	°C							
39	*Composition wt or vol % or mass flow		Average	Typical Composition					
40	H ₂		2	3.0 Max					
41	CO		1.8	4.0 Max					
42	CO ₂		-	-					
43	N ₂		0.2	16.0 Max					
44	H ₂ S		-	-					
45	O ₂		-	-					
46	H ₂ O		-	-					
47	C ₁		94	82.5 - 94.0					
48	C ₂		1	2.0 Max					
49	C ₂ =		1	2.0 Max					
50	acetylene		-	-					
51	C ₃		-	-					
52	C ₃ =		-	-					
53	iC ₄		-	-					
54	nC ₄		-	-					
55	C ₄ =		-	-					
56	C ₄ ==		-	-					
57	iC ₅		-	-					
58	nC ₅		-	-					
59	C ₅ =		-	-					
60	C ₅ ==		-	-					
61	> C ₅		-	-					
62	Ar		-	16.0 Max					
63									



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Mechanical design conditions (continued)

1	Section	Radiant	Convection						
2	Service	Reboiler							
Manifolds									
3	Inlet Manifold material (ASTM or grade)	None							
4	Manifold outside diameter	mm							
5	Design conditions T / P	°C / Barg							
6	Connection to tubes (welded, flanged, spool pieces)								
7	Flange type								
8	Flange face and finish (RM or RMS or other)								
9	Flange material (ASTM spec. or grade)								
10	Flange rating (lb)								
11	Outlet Manifold material (ASTM or grade)	None							
12	Manifold outside diameter	mm							
13	Design conditions T / P	°C / Barg							
14	Connection to tubes (welded or flanged)								
15	Flange type								
16	Flange face and finish (RM or RMS or other)								
17	Flange material (ASTM spec. or grade)								
18	Flange rating (lb)								
Crossovers									
19	Location (internal or external)	External	(note 1)						
20	Pipe material (ASTM spec. or grade)	A106B							
21	Pipe size (outside diameter)	mm	168.3						
22	Pipe thickness (average)	mm	7.11						
23	Flange material (ASTM spec. or grade)	welded							
24	Flange type								
25	Flange face and finish (RM or RMS or other)								
Tube supports									
26	Section	Radiant	Radiant	Convection					
27	Ends , top, bottom, intermediate	Top	Top	Ends					
28	Material (ASTM specification or grade)	A351	Gr HK40	CS					
29	Standard type or minimum thickness	mm	Hanger	Gusset/Bracket	12				
30	Number of sets		10	4	2				
31	Insulation type		None	None	LHV 124				
32	Service temperature	°C			1038				
33	Insulation thickness	mm			75				
34	Insulation specific gravity	kg/m3			950				
Tube guides (vertical tubes)									
35	Location (top, bottom , intermediate)	Bottom							
36	Material (ASTM specification or grade)	SS310							
37	Type	pin & stud							
38	Number per tube	one for two tubes							
Burners									
39	Location	On floor							
40	Type	Natural draft, up-fired and low Nox, Combination firing oil & gas							
41	Reference make and type	John Zink PLNC 15R							
42	Fuel type	Diesel (atomised with air), Methane Rich Gas or Combination							
43	Number	4							
44	Heat released per burner								
45	Maximum	MW	2.165						
46	Normal	MW	1.732						
47	Minimum	MW	0.722						
48	Combustion air temperature at burner	°C	ambient						
49	Pilot type and heat release	MW	one fixed lighting unit with detection and ignition combined in 1 rod (type : John Zink ST-1SE-FR)						
50	Igniter (type, portable/fixed/retractable, number)								
51	Flame detection (types and numbers)		one UV cell per burner						
52	NOx emission allowable dry, @ 3%O ₂	mg/Nm ³	450 (on hold N ₂ unknown)						
53	CO emission allowable dry, @ 3%O ₂	mg/Nm ³	100						
54	Particulate emission allowable dry, @ 3%O ₂	mg/Nm ³	50						
55	Noise SPL dB(A) @ 1m		82						
56	Noise PWL dB(A)								
57	Allowable air press.drop accross burner	mmH ₂ O	6.9						
58	Mini. req'd distance burner CL to tube CL	mm	1096						
59	Mini.req'd distance to unprotected refractory	mm	5722						
60	Mini.req'd distance to opposit burner	mm	N/A						



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Mechanical design conditions , Miscellaneous

Platforms and accesses

1	Section (radiant , convection , etc ...)	Radiant	Convection	Breeching			
2	Service (burners , sight doors , doors etc ...)	Burners	Header box	damper			
3							
4	Clearance mm	915	915	915			
5	Extent	all around	1 side + 2 ends	270°			
6	Platform floor type	grating	grating	grating			
7	Access	stairs	ladders	ladders			
8	Access floor type	grating					
9	Section (radiant , convection , etc ...)						
10	Service (burners , sight doors , doors etc ...)						
11							
12	Clearance mm						
13	Extent						
14	Platform floor type						
15	Access						
16	Access floor type						

Doors

17	Section (radiant , convection , etc ...)	Radiant	Radiant	Radiant	Radiant	Convection	Convection
18	Service (access , explosion , etc ...)	access	observation	explosion	Tube removal	inspection	cleaning
19	Dimensions mm	610 x 460	260 x 130	300 x 300	1030 x 900	610 x 610	400 x 400
20	Number	1	4	2	1	1	4
21	Type (bolted , keyed , hinged , keyed-hinged)						

Soot-blowers

22	Type (fix , rotary , semi-retractable , retractable)	1st row	2nd row	3rd row	4th row		
23	Number	none					
24	Material						
25	Stroke mm						

Miscellaneous connections

		Nb	Size	Type	Location
26	Snuffing nitrogen	2+2	2"-3/4"150#	CS Flg18/8 pipe	2@heater floor - 2@header boxes
27	Drains / Vents	2	3/4"	NPS + Plug	header boxes
28	Flue gas temperature	2	1" 3000#	CS CPLG 18/8 pipe	1@arch, 1@conv. Out.
29	Air temperature	N/A			
30	Flue gas pressure	5	1" 3000#	CS CPLG18/8 pipe	1@ floor 2@arch, 1 upstream and 1 downstream damper
31	Air pressure	N/A			
32	Skin thermocouples	6	1 1/2" 3000#	CS CPLG 18/8 pipe	(2@Rad. Outlet + 1@ Shock) per pass
33	Sample connection	3	2 " 3000#	CS CPLG 18/8 pipe CS pipe + Flg	1@floor, 1@arch, 1@conv. Outlet
34	Special connections for analyzers	N/A			

Instrumentation

		Nb	Size	Type	Location
35	Flue gas temperature	2	1"3000#	Thermowell+T/G+Transmitter	
36	Air temperature	N/A			
37	Flue gas pressure	5		4xGauge + 1xTransmitter	
38	Air pressure	N/A			
39	Skin thermocouples	6		T/G + Transmitter	
40	Oxygen analyzer	N/A			
41	CO analyzer	N/A			
42	NOx analyzer	N/A			
43	Particulate analyzer	N/A			
44	Process fluid temperature	6	1"150#	LWN FLG CS	(1@inlet, 1@Xover, 1@outlet) per pass
45	Process fluid pressure	N/A			

Other requirements

46	Surfaces preparation	SA 2.5					
47	Painting	primer					
48	Galvanizing	on grating					
49	Internal protective coating	none					
50	Painters trolley and cable	no					
51							

Associated equipment

52	Air fans	None					
53	Flue gas fans	None					
54	Combustion-air Steam heat-exchanger	None					
55	Combustion-air Flue-gas heat-exchanger	None					
56							